

MICHIGAN STATE UNIVERSITY

September 18, 2015

MEMORANDUM

TO: Dr. Douglas Estry, Associate Provost for Undergraduate Education
and Dean of Undergraduate Studies

FROM: Dr. John Gaboury, Associate Provost for Academic Services

RE: Request for a New Minor in Energy

For Transmittal to the University Committee on Undergraduate
Education (UCUE)

The request referenced above is being sent to the University Committee on Undergraduate Education (UCUE) in accordance with the *Bylaws for Academic Governance*, 4.4.

UCUE Response Requested:

Please ask the committee to consider the request referenced above and provide consultative commentary. Please mail the related materials referenced under the heading Attachments at the end of this memorandum to the committee members.

After receiving the committee's consultative response, the Provost will make a determination to forward or not to forward the request to the University Committee on Curriculum for its approval of curriculum and degree requirements.

If you have any questions, please call Joy Speas, University Curriculum Administrator, at 5-8420.

Thank you.

Attachments:

1. Request to Establish a New Academic Program form dated June 2, 2015: Minor in Energy and attachments.

s:\share\ucueenergy\mnum



University Curriculum and Catalog

Hannah Admin. Building
426 Auditorium Road
Room 151A
East Lansing, MI 48824

517-355-8420
Fax: 517-353-1935

COLLEGE OF ENGINEERING

1. Request to establish a **Minor in Energy** in the College of Engineering. The University Committee on Undergraduate Education (UCUE) will consider this request.

- a. **Background Information:**

Providing energy to the world that is clean and affordable is one of the premier challenges of the 21st century. Energy is critical across all facets of human development and the impact of non-renewable and inefficient energy generation on the world around us is becoming clear. Michigan State University has a long history of developing unique solutions to our global energy dilemma spanning solutions for energy generation, energy utilization, and energy policy. It is estimated from Destination Surveys that roughly 20% of the graduating engineering students end up with an energy company or a company closely tied to the energy industry. To complement the strong research portfolio MSU has already established in the Energy Sciences, and in response to strong constituency demand, an energy minor is proposed that focuses on key topics of fundamental laws that guide energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. This minor provides students with a foundation and perspective in energy sciences that is applicable to many disciplines and builds off of the strength of each major. The minor, will 1) better recruit top students to MSU, 2) prepare students for greater success in careers in energy, 3) showcase the efforts of MSU as a preeminent institution for the study of energy sciences, 4) further address continuous program improvement and outcomes topics as required in ABET engineering criteria.

- b. **Academic Programs Catalog Text:**

The Minor in Energy, administered by the College of Engineering, provides students with a foundation in energy science that focuses on topics of fundamental laws guiding energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. Students gain a perspective in energy science that is applicable to many disciplines and highly interdisciplinary. It offers opportunities for students to prepare to work in industry, research, or government, as well as preparation for graduate studies in energy science.

The minor is available as an elective to students who are enrolled in bachelor's degree programs in the College of Engineering. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 9 credits counted towards the requirements for this minor must be unique. Unique credits must not be used to fulfill another university, college, or major requirement in the student's program.

Students who plan to complete the requirements of the minor should consult the undergraduate adviser in the College of Engineering. Students accepted into the minor must be admitted to the College of Engineering and have completed items 1. and 2. of the requirements stated below. Enrollment for some courses may not be available and may be limited. Application forms are available at www.egr.msu.edu/academics/multi-disciplinary.

Requirements for the Minor in Energy

Complete 21 credits from the following.

1. One of the following course (3 credits):

BE	230	Engineering Analysis of Biological Systems	3
CHE	201	Material and Energy Balances	3
MSE	250	Materials Science and Engineering	3
2. One of the following courses (3 or 4 credits):

BE	351	Thermodynamics for Biological Engineering	3
CHE	321	Thermodynamics for Chemical Engineering	4
ME	201	Thermodynamics	3

	MSE	310	Phase Equilibria in Materials	3
3.	One of the following courses (3 credits):			
	BE	456	Electric Power and Control	3
	ECE	202	Circuits and Systems II	3
	ECE	345	Electronic Instrumentation and Systems	3
4.	One of the following courses (3 credits):			
	ME	417	Design of Alternative Energy Systems	3
	MSE	410	Materials Foundations for Energy Applications	3
5.	One of the following courses (3 credits):			
	AESC	310	Sustainable Systems Analysis	3
	CSUS	200	Introduction to Sustainability	3
	EEP	255	Ecological Economics	3
6.	Two of the following courses (6 to 8 credits):			
	AFRE	829	Economics of Environmental Resources	3
	BE	469	Sustainable Bioenergy Systems	3
	CHE	468	Biomass Conversion Engineering	3
	CSS	467	BioEnergy Feedstock Production	3
	CSUS	200	Introduction Sustainability	3
	CSUS	491	Special Topics in Community Sustainability	1 to 3
	ECE	305	Electromagnetic Fields and Waves I	4
	ECE	320	Energy Conversion and Power Electronics	3
	ECE	423	Power System Analysis	3
	ECE	425	Solid State Power Conversion	3
	ECE	476	Electro-Optics	4
	ECE	821	Advanced Power Electronics and Applications	3
	EEP	320	Environmental Economics	3
	ENE	481	Environmental Chemistry: Equilibrium Concepts	3
	ENE	489	Air Pollution: Science and Engineering	3
	FOR	414	Renewable Wood Products	3
	GLG	201	The Dynamic Earth	4
	GLG	301	Geology of Continents and Oceans	3
	GLG	471	Applied Geophysics	4
	ISP	221	Earth Environment and Energy	3
	MC	450	International Environmental Law and Policy	3
	ME	417	Design of Alternative Energy Systems	3
	ME	422	Introduction to Combustion	3
	ME	442	Turbomachinery	3
	ME	444	Automotive Engines	3
	MSE	410	Materials Foundations for Energy Applications	3
	MSE	460	Electronic Structure and Bonding in Materials and Devices	3

A course used to fulfill requirement 4. above may not be used to fulfill this requirement. Not all courses will be available to all majors and students must meet all course prerequisites and restrictions.

Effective Fall 2016.



Michigan State University - Office of the Registrar

View a Program

[Main Menu](#)

Joy Speas, RO

Wednesday, 9/9/2015

Program Name: Energy
Degree: MNUN Sequence Number: 1

Program Request ID: 3015

Effective Dates: Fall 2016 - Open Status: Interim Initial Action: New

Requested Date: 5/18/2015 10:08:08 AM

1. Department/School/College:

16256 College of Engineering

2. Name of Program:

Energy

3. Name of Degree:

MNUN

4. Type of Program:

Minor

5. Effective Start Semester:

Fall 2016

6. Target student audience for the program:

Engineering students interested in energy sciences

7. Enrollment:

What is the expected enrollment per year: 15

What is the minimum enrollment acceptable: 3

8. Source of budget for the program:

To align academic planning and curricular change, ALL requests for NEW funds must be included in the College's annual planning letter. Provost approval of new funds and the effective date for the new program must align. If funding is not approved, then the program request will not be forwarded to Faculty Senate.

College reallocation

If new funds, was this request included in the College's annual planning letter?

Indicate yes or no. If no, then this is a department or college fund reallocation (If the program is implemented, no additional resources are required.).

9. Projected Costs as compared to other programs in unit:

Lower

10. Staff requirement:

How many additional staff will be required: 0

Who will provide the primary instruction. Describe any external linkages(industry, government, etc.):

11. Will additional equipment be required:

Approximate cost: 0

Source of funding:

12. Will additional library materials be required:

Approximate cost: 0

Source of funding:

13. Will additional space be required:

Type:

Approximate amount: None

14. If the program requirements contain a named concentration, do you wish for the concentration to be noted on the student's transcript?:

No

15. Detailed Description:

Energy Minor in Engineering

Responses to Program Request Item 15.

15.

Detailed description:

a. Background information including the considerations which precipitated the development of the program, and its relationship to similar programs offered at MSU and by other educational institutions. Supply a copy of standards of accrediting agencies and federal regulations related to the request as appropriate.

Providing energy to the world that is clean and affordable is one of the premier challenges of the 21st century. Energy is critical across all facets of human development and the impact of non-renewable and inefficient energy generation on the world around us is becoming clear. Michigan State University has a long history of developing unique solutions to our global energy dilemma spanning solutions for energy generation, energy utilization, and energy policy. Indeed, we estimate from Destination Surveys that roughly 20% of the graduating engineering students end up with an energy company or a company closely tied to the energy industry. To complement the strong research portfolio MSU has already established in the Energy Sciences, and in response to strong constituency demand, we are developing an Energy Minor in the College of Engineering that focuses on key topics of fundamental laws that guide energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. This minor provides students with a foundation and perspective in energy sciences that is applicable to many disciplines and builds off of the strength of each major. The minor will be available as an elective to students in a bachelor's degree program in the College of Engineering. By creating this minor, we will 1) better recruit top students to MSU, 2) prepare students for greater success in careers in energy (those that are most successful often give the most back to MSU), 3) showcase the efforts of MSU as a preeminent institution for the study of energy sciences, 4) further address continuous program improvement and outcomes topics as required in ABET Engineering Criteria

There are no specific accreditation requirements or other regulations pertinent to this minor.

b. Rationale for offering the program at MSU.

This program precipitated from strong student demand and a growing realization that MSU is a leader in energy sciences. MIT currently offers a Minor in Energy but UM does not. This was therefore seen as an important opportunity to fill a key program gap and enhance our distinction over in-state peer institutions. Standards not applicable.

c. Rationale for the program being housed in the primary administrative unit.

As the minor would be available to all interested engineering students, and has been designed to have flexibility via a number of selective courses restricted to various engineering majors, it is proposed to have the College of Engineering be the primary unit, rather than a department.

d. Educational objectives of the program and their relationship to those of the college and the University.

The objective of the minor is to provide students with a foundation and perspective in energy sciences that is applicable to many disciplines and builds off of the strength of each major. The minor will be available as an elective to students in a bachelor's degree program in the College of Engineering. Students in the minor will develop proficiency in three key educational areas: 1) Energy Science Core (Energy Balance, Thermodynamics, etc.), which provide the necessary tools and language to discuss and analyze energy systems scientifically; 2) Relationship between Energy and Society (Law, Societal Context, Policy, Human Behavior, Geological Impact, Lifecycle Assessment); and 3) Engineering Energy Technologies (Automotive, Biofuels, Efficiency, Geology, Solar, Wind, etc).

e. Faculty who were instrumental in developing the program and faculty who will be responsible for implementing the program (see item 10).

There are a number of faculty responsible for developing this program: R. Lunt (lead, CHEMS), D. Miller (CHE), D. Breidis (CHE), Don Morelli (MSE), Andre Benard (ME), Chris Saffron (BE), S. Masten (ENE), A. Idema (ADUS), and T. Wolff, Associate Dean for Undergraduate Studies (ADUS). Due to the interdisciplinary nature of the minor, ADUS will be responsible for implementation. To support ADUS, an energy minor committee has been established with representatives from each department to address future program changes and includes the following department representatives: L. Genik (AES), C. Saffron (BE), D. Miller (CHE), A. Mason (ECE), A. Anttil (CEE), A. Benard (ME), R. Lunt (MSE)

f. Plan for evaluating the program. Plan for assessing student outcomes. For academic major programs, indicate the learning objectives/goals for students and how outcomes will be assessed. Visit <http://www.reg.msu.edu/UCC/assessment.asp>

The energy minor comprises a carefully selected group of courses mainly housed in the College of Engineering. To satisfy requirements of ABET accreditation Criterion 4, all ABET-accredited engineering and computer science programs conduct regular program assessment and evaluation. The ABET Student Outcomes have been mapped to the University Learning Goals (Exhibit A attached). Although not all University Learning Goals are addressed in the courses included in the Energy Minor, those outcomes that are will be assessed as part of the regular continuous improvement processes of each program whose courses are included in the minor.

g. Program description including statement and specific requirements of the program as they will appear in the University catalog. Information contained in the catalog represents a University contract with students.

See course form.

Any deviation from college and University policies must be specifically requested. For a master's degree program, indicate whether Plan A (thesis) or B (non-thesis) or both will be available.

h. If the program will be offered in a location other than the main campus in East Lansing, specify the location(s).

Not applicable

i. List the name and describe any certificate program that is associated with a new or extant degree program.

– Explain the relationship between the certificate program and a new or extant degree program.

– If a certificate program is being proposed that is related to a degree program, please explain how the department/school/college will learn that the supervising faculty have endorsed the potential certificate holders as possessing specified

skills or competency levels that render them eligible to receive the certificate and the degree.

Not applicable

j. Other information that will assist the Provost and the University-level committees in evaluating the request.

Not applicable

College of Engineering

Undergraduate Program

Minor in Energy

The Minor in Energy, which is administered by the College of Engineering, provides students with a foundation in energy science that focuses on topics of fundamental laws that guide energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. This minor provides students with a perspective in energy science that is applicable to many disciplines and highly interdisciplinary. The minor also offers opportunities for students to prepare to work in industry, research, or government, as well as to prepare for graduate studies in energy science.

The minor is available as an elective to students in a bachelor's degree program in the College of Engineering. Courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 9 unique credits counted towards the requirements for a student's minor must not be used to fulfill the requirements for that student's major.

Students who plan to complete the requirements for the minor must apply to the College of Engineering. To be accepted into the minor, the student must be admitted into the College of Engineering. The minimum criteria for acceptance is the completion of their choice of areas 1 and 2 outlined below. Enrollment for some courses may not be available and enrollment may be limited.

Application forms are available at <http://www.egr.msu.edu/academics/multi-disciplinary>

Requirements for the Minor in Energy

Complete 21 credits from the following:

1. One of the following courses (3 credits):

CHE 201	Material and Energy Balances	3
BE 230	Engineering Analysis of Biological Systems	3
MSE 250	Materials Science and Engineering	3

2. One of the following courses (3 credits):

ME 201	Thermodynamics	3
MSE 310	Phase Equilibria in Materials	3
CHE 321	Thermodynamics for Chemical Engineering	3 4
BE 351	Thermodynamics for Biological Engineering	3

3. One of the following courses (3 credits):

ECE 202	Circuits and Systems II	3
ECE 345	Electronic Instrumentation and Systems	3
BE 456	Electric Power and Control	3

4. One of the following courses (3 credits):

MSE 410	Materials Foundations for Energy Applications	3
ME 417	Design of Alternative Energy Systems	3

5. One of the following courses (3 credits):

FW204	Energy Issues in Natural Resource Management	3
EEP 255	Ecological Economics	3
CSUS 200	Introduction to Sustainability	3
AESC 310	Sustainable Systems Analysis	3

2 per Jim Schneider

6. Two of the following courses (6 credits):

MSE 410	Materials Foundations for Energy Applications	3
ME 417	Design of Alternative Energy Systems	3
ME 422	Introduction to Combustion	3
ME 442	Turbomachinery	3
ME 444	Automotive Engines	3
FOR 414	Renewable Wood Products	3
CSS 467	BioEnergy Feedstock Production	3
CHE 468	Biomass Conversion Engineering	3
BE 469	Sustainable Bioenergy Systems	3
MSE 460	Electronic Structure and Bonding in Materials and Devices	3
ECE 476	Electro-Optics	3-4
EEP 320	Environmental Economics	3
MC 450	International Environmental Law and Policy	3
SOC 452	Environment and Society	3
ACR 472	Selected Topics in Sustainability	1-3
AEC 829	The Economics of Environmental Resources	3
ECE 305	Electromagnetic Fields and Waves I	4
ECE 320	Energy Conversion and Power Electronics	3
ECE 423	Power System Analysis	3
ECE 425	Solid State Power Conversion	3
ECE 821	Advanced Power Electronics and Applications	3
GLG 201	The Dynamic Earth	4
ISP 221	Earth Environment and Energy	3
GLG 301	Geology of the Great Lakes Region	3
GLG 471	Applied Geophysics	4
CSUS 200	Introduction to Sustainability	3
ACR 387	Sustainability Practicum	2
ENE 481	Environmental Chemistry: Equilibrium Concepts	3
ENE 489	Air Pollution: Science and Engineering	3

2 per Neeraj Buch & SOC

*CSUS 491
AFRE*

SPS 491

Continents and Oceans

no such course

A course used to fulfill a requirement 4 may not be used to fulfill this requirement. Not all courses will be available to all majors and students must meet any existing course pre-requisites/restrictions.

16. Are there admissions requirements for this program?:

Grade or grade-point average requirements and if so in which course(s), portfolio requirement, audition, essay, etc. If there are not admission requirements other than those required by the University policy indicate "none".

Admitted to the College of Engineering

DEPARTMENT LEVEL APPROVAL STATUS

Approved: College of Engineering
5/18/2015 4:24:25 PM by Mary Pease for Thomas F. Wolff, Associate Dean

SIGNOFFS STATUS

Signed Off: College of Agriculture and Natural Resources
5/27/2015 6:32:52 AM by Kelly Millenbah for Kelly Millenbah, Associate Dean

Comments: FW 204 no longer offered. Will need to be removed. Note: EEP 255 and EEP 320 will change to EEM 225 and EEM 320 in the coming year.

No Response by: College of Natural Science

COLLEGE LEVEL APPROVAL STATUS

Approved: College of Engineering
6/2/2015 12:13:17 PM by Thomas Wolff for Thomas F. Wolff, Associate Dean

MICHIGAN STATE
UNIVERSITY

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TEACHER CERTIFICATION OPTION

A computer science disciplinary minor in the College of Engineering is available for teacher certification.

Students who elect the computer science disciplinary minor must contact the Department of Computer Science and Engineering.

For additional information, refer to the statement on *TEACHER CERTIFICATION* in the *Department of Teacher Education* section of this catalog.

Insert ①

GRADUATE STUDY

MINOR IN ENERGY

The Minor in Energy, administered by the College of Engineering, provides students with a foundation in energy science that focuses on topics of fundamental laws guiding energy generation, utilization, conservation, engineering applications and the impact of energy within a societal and geological context. Students gain a perspective in energy science that is applicable to many disciplines and highly interdisciplinary. It offers opportunities for students to prepare to work in industry, research, or government, as well as preparation for graduate studies in energy science.

The minor is available as an elective to students who are enrolled in bachelor's degree programs in the College of Engineering. With the approval of the department and college that administer the student's degree program, the courses that are used to satisfy the minor may also be used to satisfy the requirements for the bachelor's degree. At least 9 credits counted towards the requirements for this minor must be unique. Unique credits must not be used to fulfill another university, college, or major requirement in the student's program.

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Requirements for the Minor in Energy

Complete 21 credits from the following.

1. One of the following course (3 credits):

BE	230	Engineering Analysis of Biological Systems	3
CHE	201	Material and Energy Balances	3
MSE	250	Materials Science and Engineering	3
2. One of the following courses (3 or 4 credits):

BE	351	Thermodynamics for Biological Engineering	3
CHE	321	Thermodynamics for Chemical Engineering	4
ME	201	Thermodynamics	3
MSE	310	Phase Equilibria in Materials	3
3. One of the following courses (3 credits):

BE	456	Electric Power and Control	3
ECE	202	Circuits and Systems II	3
ECE	345	Electronic Instrumentation and Systems	3
4. One of the following courses (3 credits):

ME	417	Design of Alternative Energy Systems	3
MSE	410	Materials Foundations for Energy Applications	3
5. One of the following courses (3 credits):

AESC	310	Sustainable Systems Analysis	3
CSUS	200	Introduction to Sustainability	3
EEP	255	Ecological Economics	3
6. Two of the following courses (6 to 8 credits):

AFRE	829	Economics of Environmental Resources	3
BE	469	Sustainable Bioenergy Systems	3
CHE	468	Biomass Conversion Engineering	3
CSS	467	BioEnergy Feedstock Production	3
CSUS	200	Introduction Sustainability	3
CSUS	491	Special Topics in Community Sustainability	1 to 3
ECE	305	Electromagnetic Fields and Waves I	4
ECE	320	Energy Conversion and Power Electronics	3
ECE	423	Power System Analysis	3
ECE	425	Solid State Power Conversion	3
ECE	476	Electro-Optics	4

ECE	821	Advanced Power Electronics and Applications	3
EEP	320	Environmental Economics	3
ENE	481	Environmental Chemistry: Equilibrium Concepts	3
ENE	489	Air Pollution: Science and Engineering	3
FOR	414	Renewable Wood Products	3
GLG	201	The Dynamic Earth	4
GLG	301	Geology of Continents and Oceans	3
GLG	471	Applied Geophysics	4
ISP	221	Earth Environment and Energy	3
MC	450	International Environmental Law and Policy	3
ME	417	Design of Alternative Energy Systems	3
ME	422	Introduction to Combustion	3
ME	442	Turbomachinery	3
ME	444	Automotive Engines	3
MSE	410	Materials Foundations for Energy Applications	3
MSE	460	Electronic Structure and Bonding in Materials and Devices	3

A course used to fulfill requirement 4. above may not be used to fulfill this requirement. Not all courses will be available to all majors and students must meet all course prerequisites and restrictions.